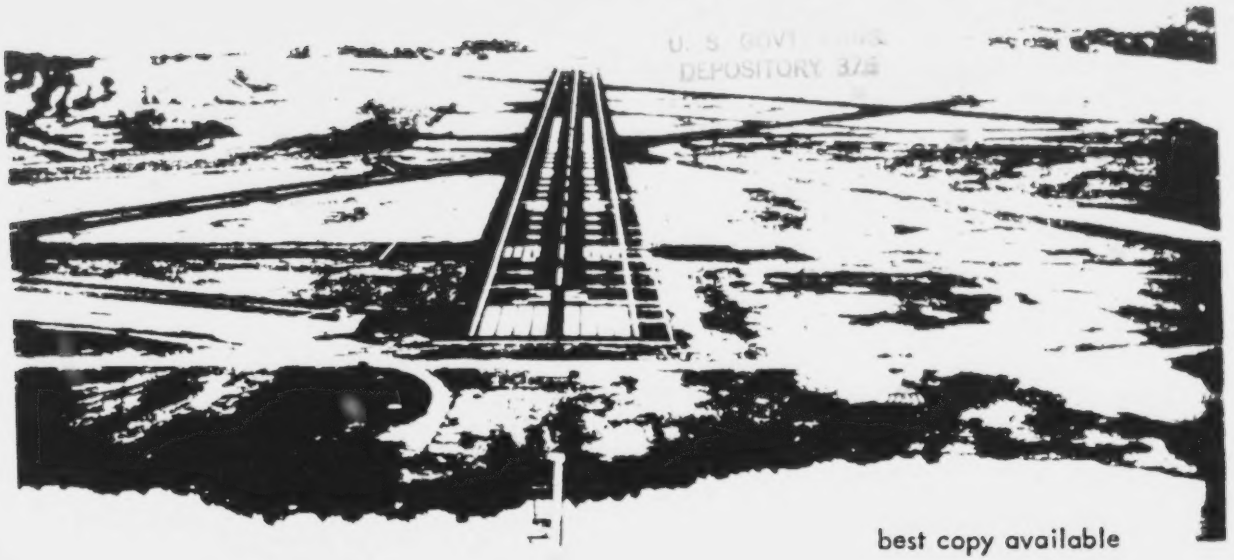
412-051-8863-A

IDENTIFY ESSENTIAL ELEMENTS OF TERRAIN INFORMATION FROM STANDARD REMOTE SENSED IMAGERY (AIRFIELDS)

TEC Lesson 412-051-8863-A

MAY 5 1986
U.S. GOVT. DOCS.
DEPOSITORY 378



best copy available

PRODUCED BY
UNITED STATES ARMY
ENGINEER SCHOOL
FORT BELVOIR, VIRGINIA

STUDENT/SUPERVISOR INSTRUCTIONS, PRETEST/POSTTEST, AND ANSWER KEY ARE CONTAINED IN THIS BOOK

NOVEMBER 1985

D 101.6/7:

If you have questions or comments concerning this TEC Lesson, address them to:

Commandant
U.S. Army Engineer School
ATTN: ATZA-TD-I-E*
Fort Belvoir, VA 22060-5291

* Current symbol may be obtained from DA Pam 350-100, Appendix C.

READ THE STUDENT/SUPERVISOR INSTRUCTIONS CAREFULLY. BE SURE YOU UNDERSTAND THEM COMPLETELY BEFORE CONTINUING THE LESSON.

The words "he," "his," and "men," when used in this publication, represent both the masculine and feminine genders, unless otherwise specifically stated.

STUDENT/SUPERVISOR INSTRUCTIONS

AUDIENCE:

- MOS 81Q - Terrain Analyst
- Skill Level 2

TRAINING OBJECTIVE:

- Identify runways, trailways and parking areas.
- Identify hangars and support facilities.

MATERIALS/EQUIPMENT:

- TEC booklet
- Pocket stereoscope
- Writing materials, pencil

TIME REQUIREMENT:

- No time limit

REFERENCES:

- FM 30-10 – Military Geographic Intelligence (MGI) Terrain, Chapter 5, para. 5-12 to 5-17.
- TEC Tape Number 411-051-8982F, Determine Scales of Photos & Maps.

PREREQUISITES:

- Completion of BTAC (Basic Terrain Analysis Course)
- OJT

READEX FICHE

STUDENT/SUPERVISOR INSTRUCTIONS

STUDENT INSTRUCTIONS

- If you have not taken a printed text TEC lesson before, ask for assistance.
- Work through this lesson as many times as necessary to master all skills and knowledge covered by the lesson.
- Use the tables provided with this text to make computations
- Follow instructions—DO NOT TAKE SHORT CUTS.

SUPERVISOR INSTRUCTIONS

- This lesson is self-contained and needs no special consideration when used in the individual mode except gathering the required equipment and/or materials.
- Administer the pretest to determine if the soldier should take the lesson.
- Use the posttest to determine if each soldier has mastered the skills and knowledge covered in this lesson or if he needs to retake the lesson.
- If possible, administer a performance test to the soldier upon completion of the lesson.
- When using this lesson for groups:

  a. Administer the lesson to no more than ten soldiers at a time.

  b. Make sure the soldiers have all the required materials and equipment.

  c. Remind the soldiers to use the tables provided with this lesson.

PRETEST/POSTTEST

TEC LESSON 412-051-8863-A

IDENTIFY ESSENTIAL ELEMENTS
OF TERRAIN INFORMATION FROM
STANDARD REMOTE SENSED IMAGERY

This test consists of 7 questions that cover every training objective of the lesson. These questions have a total value of 100 points. When you have completed the test, check your answers against the Pretest/Posttest Answer Key on page 43. If you do not score at least 80 points, you must take the lesson - or take it again if you have already taken it. Write your responses on a separate sheet of paper. Do not write in this book.

PRETEST/POSTTEST

1. Temporary runways can be identified by:
   (a) Distinct edges, smooth furfaces
   (b) Neat in appearance, distinctive pattern
   (c) Uneven edges, limited runway markings
   (d) Uneven edges, permanent runway markings
2. Given the following photoidentification keys, identify the type of runway:
   (a) Permanent runway markings
   (b) Neat in appearance
   (c) Distinct edges

3. Runway direction numbers can be _____ or _____ digit numbers.

4. What type of surface can be identified, given the following photoidentification keys:

   (a) Light to dark color, mottled
   (b) Open pits in vicinity
   (c) Uneven edges

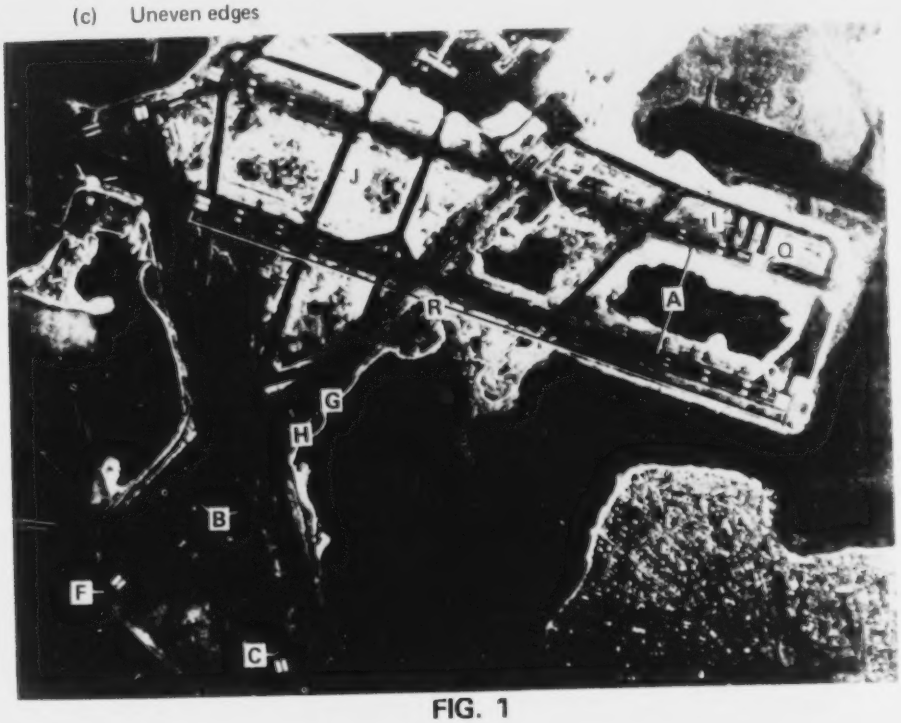


FIG. 1

5. (Fig. 1). Identify the following runway characteristics.

A _____
B _____
C _____
F _____
G _____
H _____
J _____
I _____
Q _____
R _____

FIG. 2

6. Identify the following features (Fig. 2)

   L _____
   M _____
   N _____
   U _____

7. Given the following PI keys: Multistory construction, located next to main roads, parking lots and loop driveways, identify the type of buildings:
   (a) hangars
   (b) terminals

INTRODUCTION

The word "AIRFIELD" is used in the broadest sense, regardless of the complexity of its supporting facilities. The term is commonly applied to such diverse installations as airbases, airports, airstrips, landing strips. air depots, heliports, helipads and seaplane stations.

Whether military or civilian, airfields play a significant role in the lines of communication systems, and are important factors in the study of transportation intelligence.

Terrain analysts are principally concerned with the type of airfield, its physical dimensions, construction material, condition and the nature of its support facilities.

The terrain analyst must make positive identification of these facilities, in order to facilitate commanders making accurate evaluation of the airfield capabilities.

This lesson parallels Task No. 051-259-2008 of Soldier's Manual FM 5-81Q 1/2 – Terrain Analyst.

TEC LESSON

Identify Runway/Taxiways/Parking areas (Figure 1).

Type of Runways:

Runways are the most prominent and significant features of an airfield. Accurate identification of the type of runway is very essential in order to properly evaluate their capabilities. There are principally two types of runways: Permanent and Temporary.

- Permanent runways, also called "All Weather Instrument or Basic Runways" can be identified using the following photo identification characteristics: (see Figure 1).
  - Permanent surfaces, such as concrete or asphalt have distinct edges and ends
  - Neat in appearance
  - Distinctive pattern
  - Permanent runway markings/neatly painted
- Temporary runways, or "expedient runways" can be identified using the following photo identification characteristics:
  - Ragged and uneven edges—an indication of soil stabilized pavement or the presence of a membrane or metal landing mats
  - Limited runway markings (not neat in appearance)

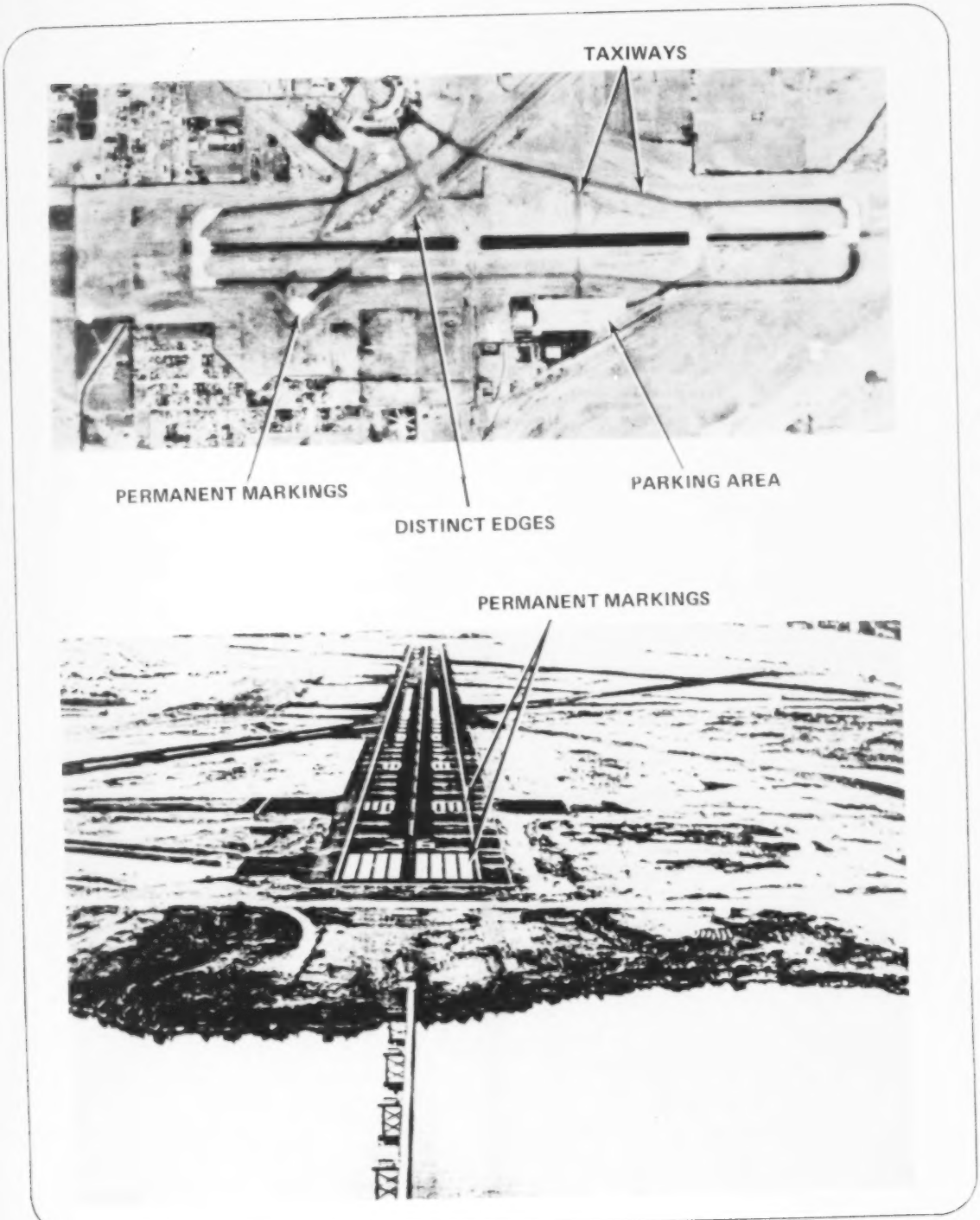


FIG. 1 PERMANENT RUNWAYS

Runways can be described as either single, parallel or intersecting. Airfields may contain one or all three of the basic configurations (see Figure 2).

(fig 2 here)

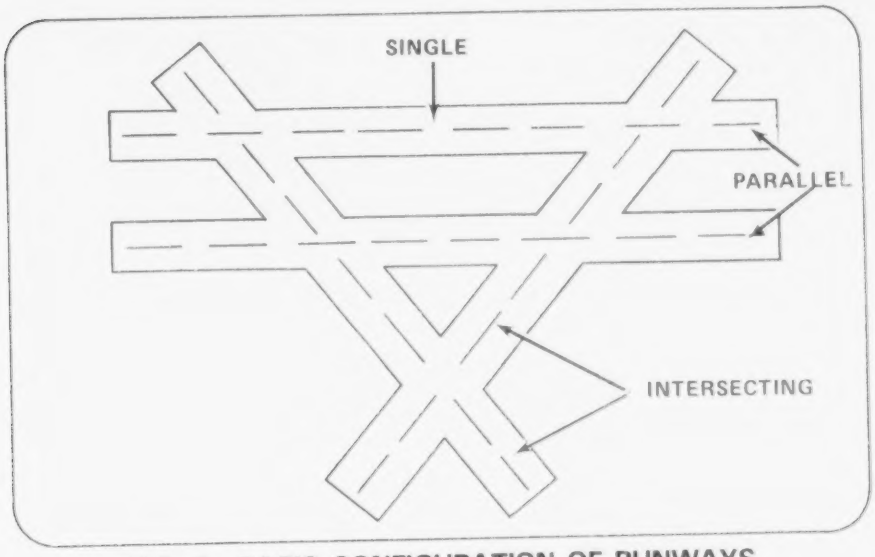


FIG. 2 BASIC CONFIGURATION OF RUNWAYS

To make a complete identification for runway types, the analyst must be specific in identifying those runways which are permanent and those which are temporary (expedient) in nature. Proper identification and documentation will enable the commander to accurately evaluate the airfield capabilities.

Identify Runway markings: (Fig. 3)

The airfield markings serves as a visual aid in landing aircraft. There are four elements of runway markings which can be identified from aerial photographs. These are:

- Centerline marking
- Runway direction numbers
- Threshold markings
- Landing zone and edge stripes (see Figure 3)

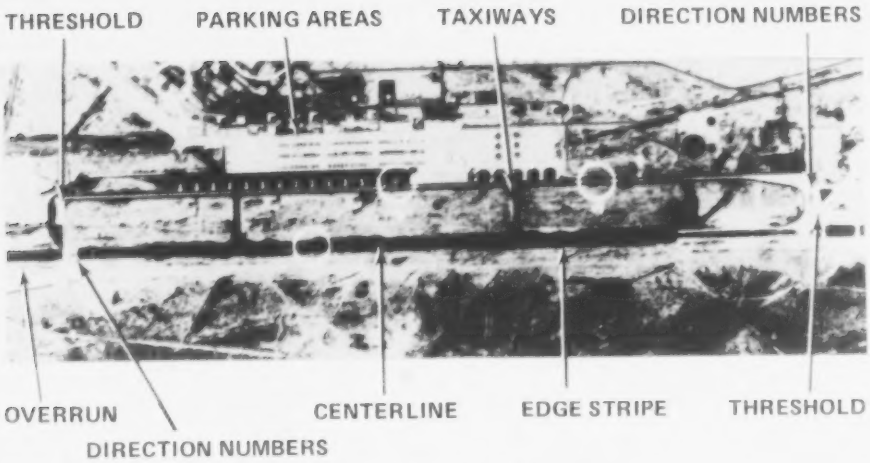


FIG. 3 RUNWAY MARKINGS

- Centerline Markings: (Fig. 4). These can be identified by a straight broken line that runs along the center of the runway, from threshold to threshold. The threshold signifies the end of the usable runway.
- Runway Direction Markers: (Fig. 4). These are used on hardtop runways, but not landing mat/membrane surfaces. These numbers serve two purposes.
  - Designates the direction of the runway
  - Accents the end limits of the landing and takeoff areas.

They can be identified as one or two digit numbers on either ends of the runway and are located near the threshold.

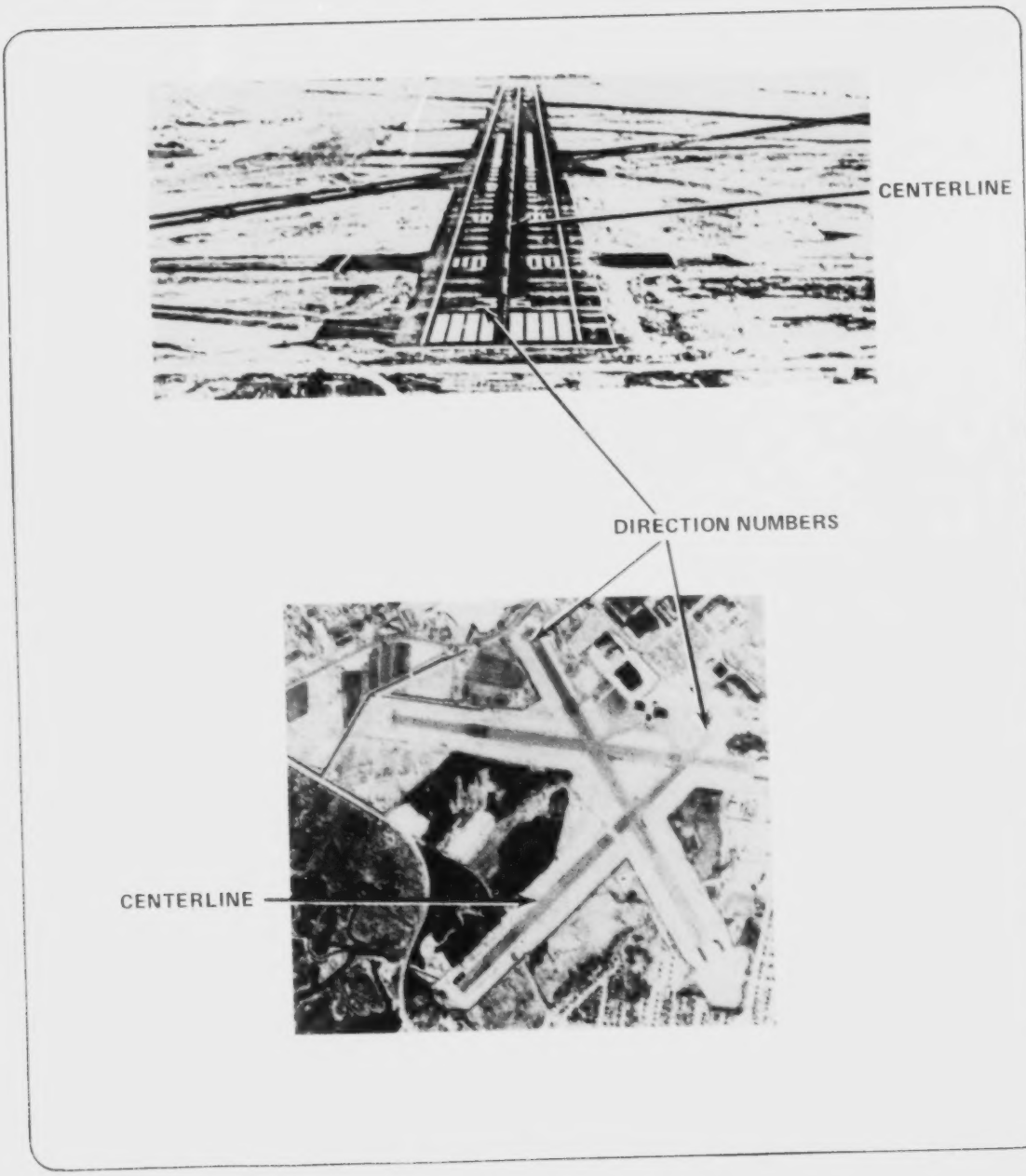
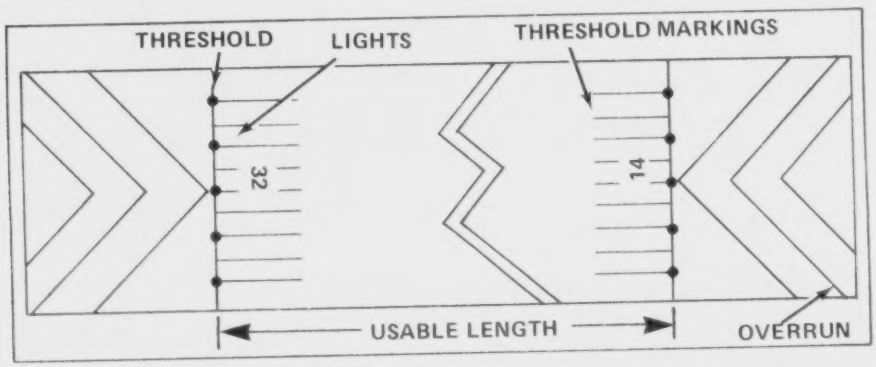


FIG. 4 RUNWAY DIRECTION NUMBERS/CENTERLINE

- Threshold Marks: These marks signify the ends of the usable runway and does not include the overrun area.

This mark can be identified as a distinct line which separates the usable runway from the overrun area.



Basic runway markings (centerline and direction numbers) are used for operation under VFR (Visual Flight Rules).

- Landing Zone and Edge Stripes: (Fig. 5).

These markings can be identified as solid white lines that run the length and along the edges of the runway. The distance between these two lines determines the usable width of the runway.

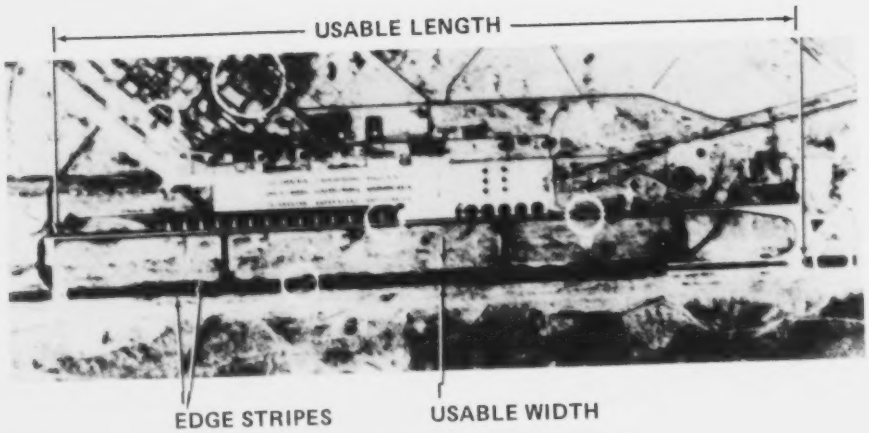


FIG. 5 RUNWAY DIMENSIONS

- In the case of expedient construction, the basic runway markings are not visible on the runway. The ends of the runway are accentuated with a rectangular splash of line, paint, or other compound that will stand out.

Identify and Compute Length and Width of Runway:

The length and width of the runway are calculated using the formula GD = PD x DPS, where:

GD represents Ground Distance
PD represents Photo Distance
DPS represents Denomination of Photo Scale

Follow these steps in determining length/width of the runway:

- Identify threshold marks (for usable length), edge stripes (for usable width).
- Measure distance between these marks. This represents the Photo Distance (PD).
- Determine Scale of the Photography (PS), using one of three methods:
  - $PS = \frac{PD}{GD}$
  - $PS = \frac{f}{H-h}$
  - $PS = \frac{PD}{MD \times DMS}$

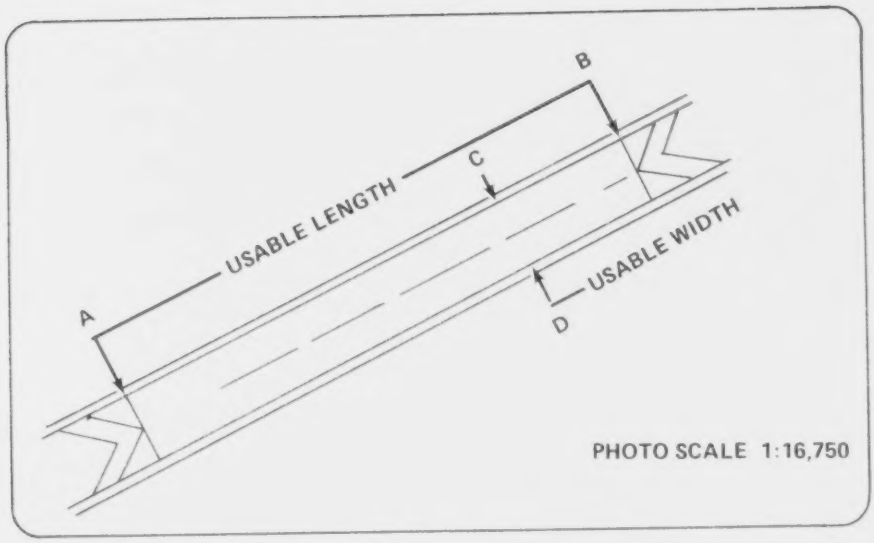
NOTE

Refer to TEC Lesson No. 411-051-8852-F if you are unsure as to how to determine the scale of aerial photographs.

- Substitute these values into the appropriate formula and calculate.

Follow similar procedures to determine the dimension for taxiways and parking areas/aprons.

Refer to Examples I and II for a visual understanding of usable length and width.



Example 1: Compute length of runway.

Example 1: Compute length of runway.

(1) . . . . . GD = PD x DPS

PD = AB = .4422′

DPS = 16,750

(2) . . . . . GD = .4422′ x 16,750

= 7406.85 feet

Example 2: Compute width of runway.

(1) . . . . . GD = PD x DPS

PD = CD = .0085′

DPS = 16,750

(2) . . . . . GD = .0085′ x 16,750

= 142.38 feet

Identify Surface Materials

Runways, parking areas and taxiways are constructed with many different types of materials. Each type appears differently on aerial photographs. The following table will assist you in identifying the different types of surface materials.

Table 1. SURFACE MATERIALS IDENTIFICATION KEYS

Type of Surface	Surface Outlook	Tone	Other
Sod	Irregular	Brown to green, mottled	Tire tracks
Graded earth, gravel, sand, coral, clay	May have grader marks	Light to dark color, mottled	Open pits in vicinity (source of surfacing material)
Pierced steel plank	Grid pattern	Brown to green, mottled	Piles of steel plank in area
Concrete	Smooth, surface may be patched or painted	Light grey to white, uniform	Block pattern
Asphalt	Smooth, surface may be patched or painted	Very dark to light grey, usually uniform	None

Taxiways/Parking Areas

- Taxiways

  These are access paths to parking aprons, hangars, buildings, hardstands and revetments. The following photoidentification keys will help identify Taxiways:

  - Narrower than runways
  - Taxiways generally form a loop system with the runway
  - Solid center line
  - The absence of basic runway markings (edge stripes, direction numbers, overrun and threshold)

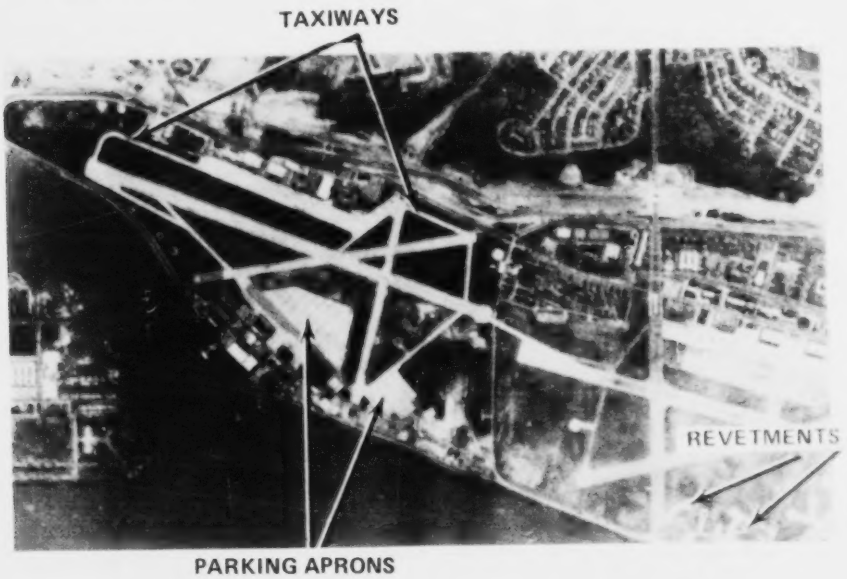


FIG. 6 TAXIWAYS/PARKING APRONS

- Parking Areas

  This is a prepared area for the parking of aircraft. They are normally used for servicing, minor repairs of aircraft and for "on and off' loading of cargo and passengers. Parking areas are identified by:

  - The presence of parked aircraft
  - Found near administration buildings, passenger and freight terminals
  - The presence of revetments around the perimeter of the airfield
  - Aircraft are generally parked uniformly
  - Markings to denote lane parking of aircraft may sometimes be present.

PRACTICE EXERCISE 1

Now, let's try a practice exercise. Write your answer on a separate sheet of paper. A discussion and correct answers appear at the end of the practice exercise.

PRACTICE EXERCISE 1

1. There are two types of runways:

   a _____ b _____

2. A runway with distinct edges and permanent runway markings, is identified as a

   _____ runway.

3. Fig. 1: (Questions 3a through 3e): Identify the following runway characteristics:

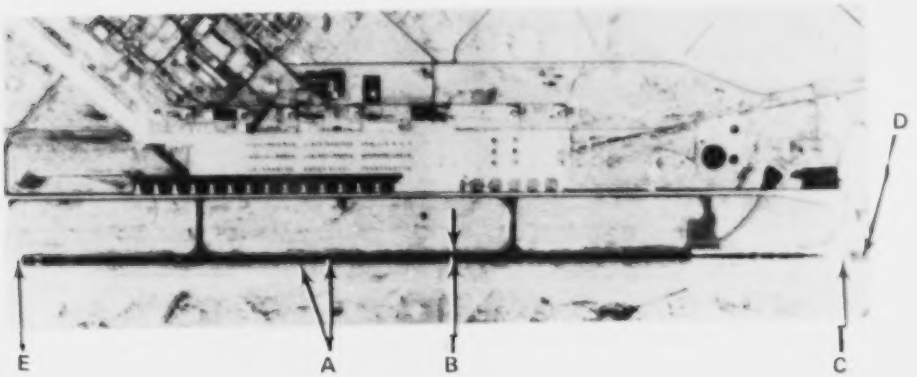


FIG. 1

A _____

B _____

C _____

D _____

E _____

4. What type of surface is identified by the following photo identification keys:
   Smooth, Usually Uniform, Very Dark to Light grey. _____
   concrete / sod /alphalt

PRACTICE EXERCISE 1

5. Temporary runways cen be identified by: (Select the best answer):
   a. Neat appearance
   b. The presence of landing mats
   c. Permanent runway markings
   d. Distinct runway edges

6. What type of runway is indicated by the following PI key?
   a. Irregular with tire tracks
   b. Grader marks

7. Use Figure 2: Identify areas indicated by F and G.

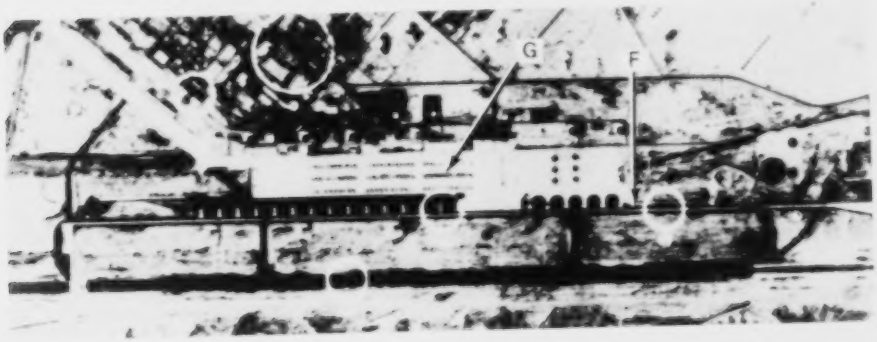


FIG. 2

F _____

G _____

SOLUTIONS: PRACTICE EXERCISE 1

1. a. Permament
   b. Temporary

2. Permanent

3. a. Edge stripes
   b. Centerline
   c. Threshold
   d. Overrun
   e. Direction numbers

4. Asphalt

5. b. The presence of landing mats

6. Temporary

7. F – Taxiway
   G – Parking apron

Identify Hangars and Support Facilities

This section will enable you to correctly identify the most important supply and support facilities. The following facilities will be covered in this section:

- Hangars
- Administration/Personnel Buildings
- POL Storage Facilities
- Ordnance Storage

Hangars

Hangars are perhaps the most easily recognized features of an airfield since they are relatively large structures of distinctive design. Information on the number and types of hangars provides a general indicator as to the extent and type of operations. There are several types of hangars. See Figure 1.

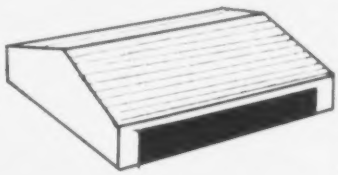
- Double lean-to
- Multiple bay
- Steel arch
- Cantilever
- Alert hangar

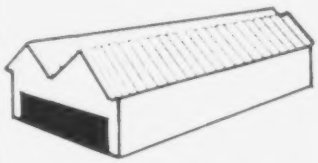
Hangar facilities can be easily recognized because of their size and distinctive design. Double lean-to hangars are a familiar wartime wooden hangar. They accommodate 2 or more aircraft. Multiple bay hangars consist of 2 or more sections built of concrete and steel. The roof may be "M" type or double arch. Steel arch is a general purpose hangar

which accommodates large aircraft. Cantilever are the largest type of hangars with an arch roof. Alert hangars are found near the end of runways.

The type of hangars generally found are as follows:

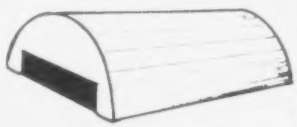
Double Lean-to Hangar—This type of hangar dates back to World War II and before. It is usually constructed of wood and accommodates two aircraft, one on each side of the building.

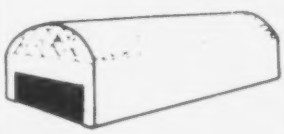




Multiple Bay Hangar—This type of structure contains two or more bays or sections, usually built of concrete, with steel roof. The roof may be the "M" type (as shown) or multi-arched.

Steel Arch Hangar—This is a general purpose hangar, which normally accommodates most large aircraft presently in service. This all steel structure usually contains office and workshop space sections along the inner sides of the hangar.





Cantilever Hangar—This is the largest type of hangar. It has a center section providing support for the large cantilever roof spans. The center section provides office and workshop areas. The length of this type of hangar has the capability of being extended to any size required by a particular airfield. The roof may be arched (as shown) or peaked.

FIGURE 1

Hangar facilities are located in areas where large parking aprons are distinct. They are normally constructed away from runways, except for alert hangars which are located near the ends of runways. Hangar facilities have large bay doors. See Figure 2.

FIG. 2 HANGARS

Administration and Personnel Buildings:

These facilities include operation and terminal buildings and personnel living quarters. They may be recognized by one or more of the following photo interpretation keys: See Figure 3.

- Muitistory construction or multiwing design
- Located next to or on main roads
- Presence of parking lots and loop driveways
- Presence of a control tower
- Extensive landscaping
- Recreation facilities (playgrounds, baseball field)

Although, in most modern airfields, the appearance of buildings may differ, each country tends to develop a standard type of construction for its buildings.

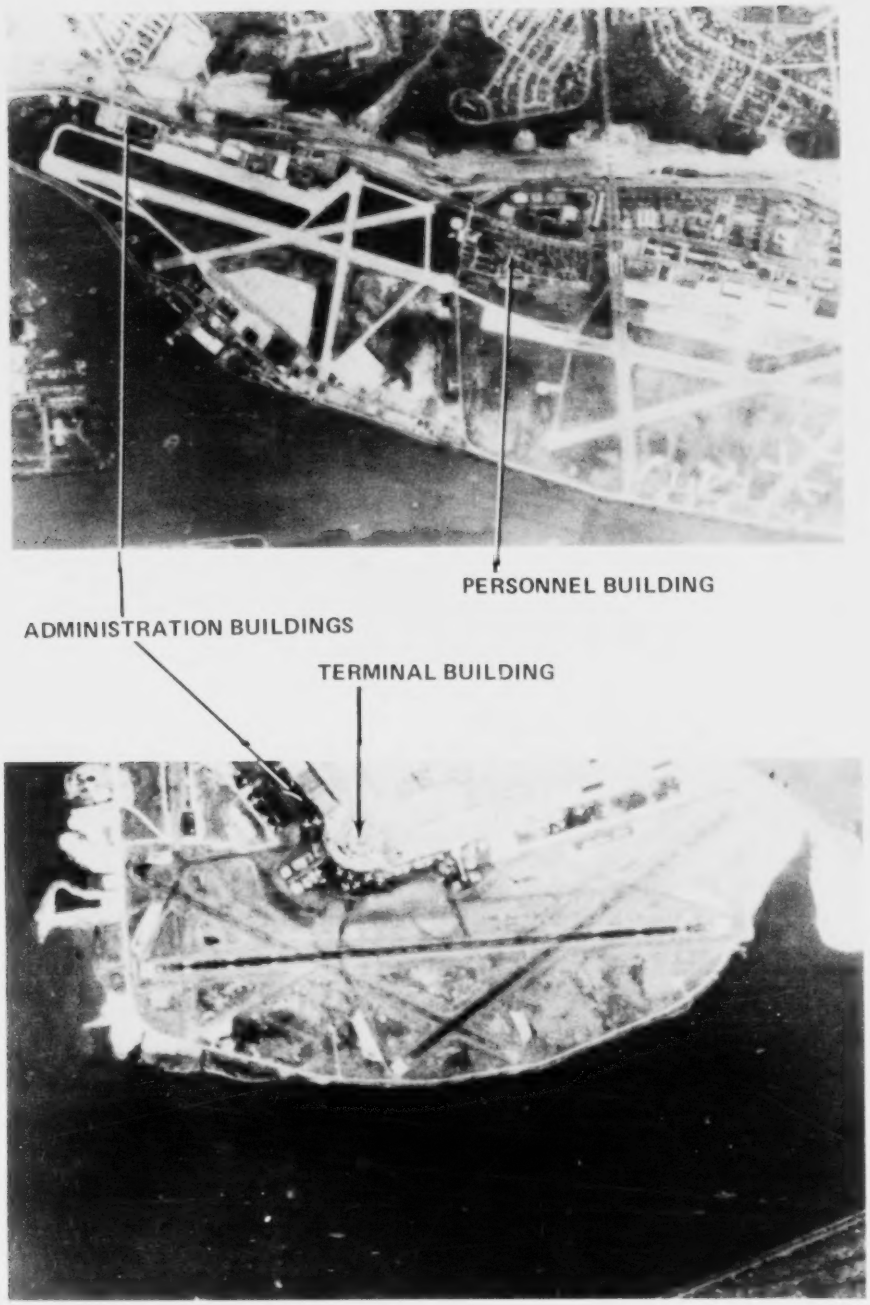


FIG. 3 ADMINISTRATION/PERSONNEL BUILDINGS

Petroleum, Oil and Lubricant (POL) Storage Facilities:

POL storage is a very critical item related to an airfield. They may be constructed above ground and partially or completely underground. See Figure 4.

The following identification characteristics may help recognize POL facilities:

Above Ground POL Storage:

- Storage tanks in vertical or horizontal positions
- Fire breaks or firewalls around each tank
- Transportation facilities nearby (railroads, roads)
- Service roads lead to the area
- Pipelines are often present in the area
- A fence may surround the area
- Oil spills visible on the hard surface
- POL tank trucks

Partially/Completely Underground:

- Area may be covered with a hard surface, e.g. concrete or asphalt
- Area may be surrounded by a fence
- Refueling pumps apparent
- Located conveniently to landing area and/or servicing area
- POL trucks or tank cars in the area
- Ditch surrounding the area
- Above ground pipelines may be visible

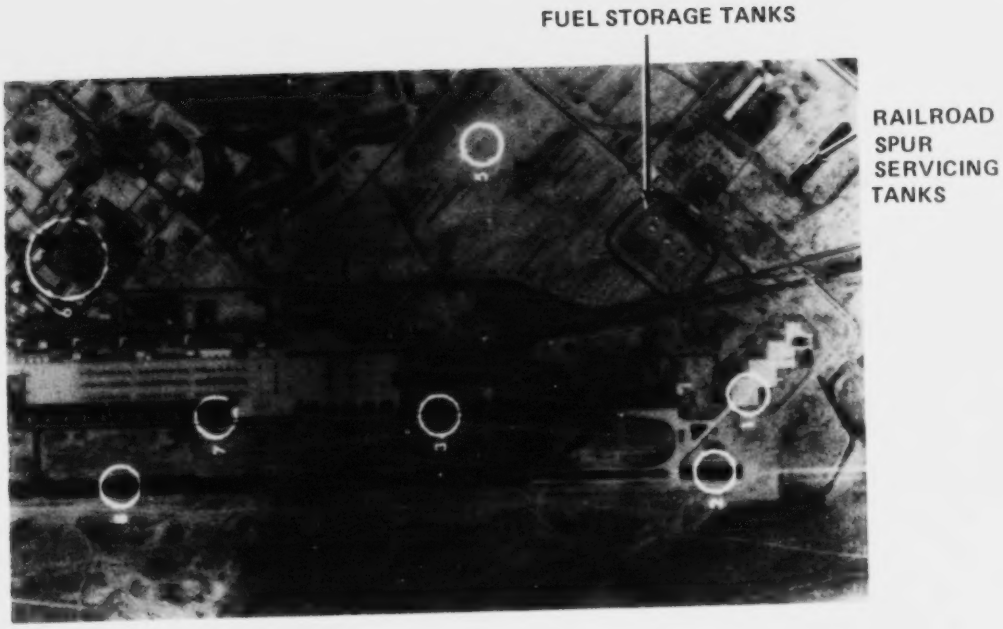


FIG. 4 FUEL STORAGE

PRACTICE EXERCISE 2

Now, let's try a practice exercise. Write your answer on a separate sheet of paper. A discussion and correct answers appear at the end of the practice exercise.

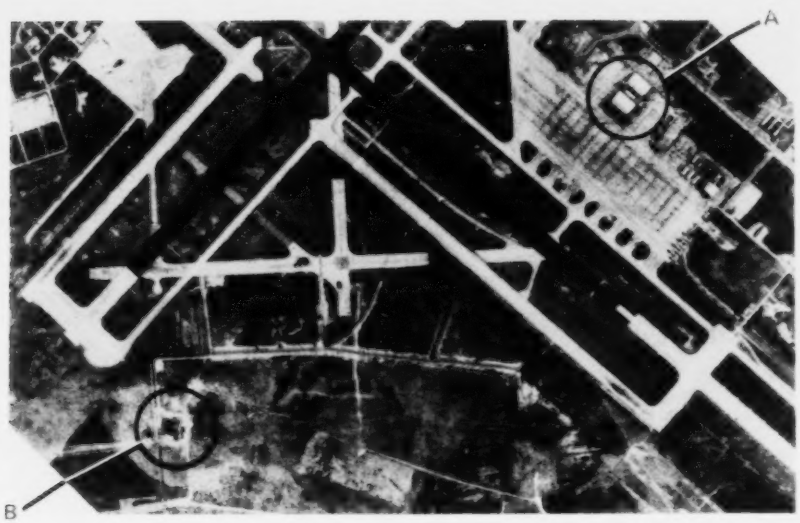
PRACTICE EXERCISE 2

1. Identify the feature, given the following PI keys:
   a. Large structure of distinctive design
   b. Roof may be arched.
   c. Large bay doors

2. Identify the feature, given the following PI keys:
   a. Multistory construction
   b. Presence of parking lots
   c. Next to main roads
   d. Extensive landscaping

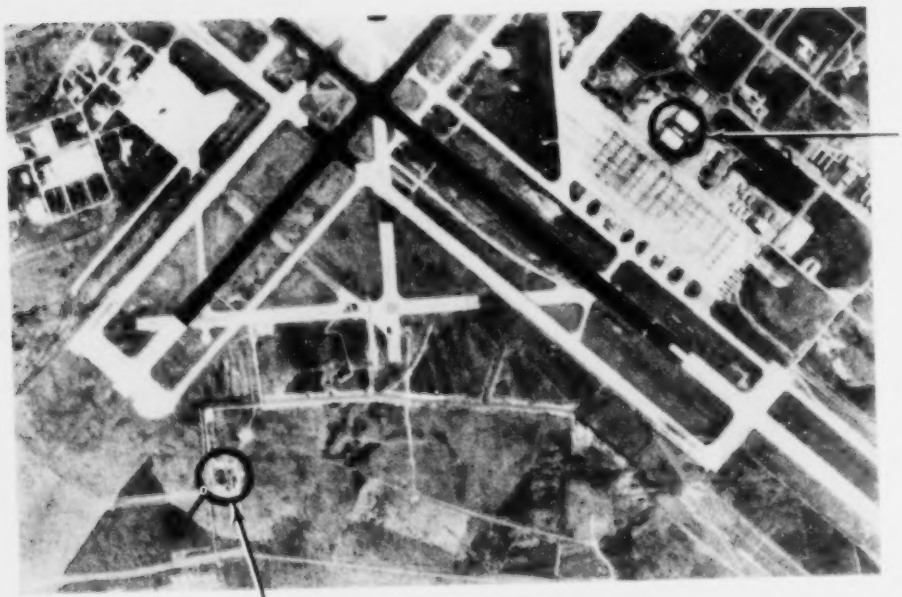
3. Which PI key best identifies a POL storage facility?
   a. Storage tanks in a fenced area
   b. Bunker type construction
   c. Ditch surrounding area
   d. Located next to servicing area

4. Identify the following features:



SOLUTION
PRACTICE EXERCISE 2

1. Hangar
2. Administration or terminal buildings
3. Storage tanks



A. Hangars—Large structures of distinctive design. Arched roof and the presence of parking aprons.

B. POL Storage—Presence of storage tanks, with access road. Located in an isolated area.

If you have any difficulty with the Practice Exercises, go back and review the preceding sections. If, however, you are completely satisfied that you can:

- Identify runway, taxiways and parking areas
- Identify hangars and support facilities,

you are now ready to take the self evaluation exercises starting on the next page.

SELF-EVALUATION EXERCISE

This self evaluation is in two parts. Part I is a series of multiple choice questions and Part II is a series of questions which requires you to identify airfield facilities from an aerial photograph. This is designed to test your knowledge pertaining to this lesson.

PART I (Five Questions)

1. A permanent runway has: (select the best answer)
   a. Unpaved surface
   b. No center line
   c. Distinct edges
   d. Landing mat

2. A temporary runway has: (select the best answer)
   a. Distinct edges
   b. Center lines
   c. Paved surface
   d. Uneven edges

3. The usable length of a runway is measured from (select best answer)
   a. Overrun area to overrun area
   b. Outer ends of paved surface
   c. Direction number to direction number
   d. Threshold to threshold

4. The usable width of a runway is measured from: (select best answer)
   a. Direction number to direction number
   b. Overrun area to overrun area
   c. Edge stripe to edge stripe
   d. Threshold to threshold

5. What type of surface is identified: _____
   sod/ concrete/asphalt
   a. Smooth and uniform surface
   b. Very dark to light grey
   c. Neat in appearance

PART II (all questions are referenced to Photo 1)

6. Identify the following features:
   1.
   2.
   3.
   4.
   5.
   6.
   7.
   8.
   9.

PHOTO 1

ANSWERS TO SELF-EVALUATION EXERCISE

SOLUTION TO SELF-EVALUATION

PART I:

1. (c) distinct edges
2. (d) uneven edges
3. (d) threshold to threshold
4. (c) edge stripe to edge stripe
5. asphalt

PART II

6. 1. Parking apron (alert)
   2. Overrun
   3. Taxiway
   4. Hangars
   5. Parking area
   6. Supply/Support facilities
   7. Parking apron and taxiway
   8. Runway
   9. POL Storage

CONCLUSION

If you have any problems with this lesson, review those areas which you do not completely understand. However, if you feel satisfied that you have full knowledge of all aspects of this lesson, proceed to the Post-Test.

SOLUTION TO PRE-POST TEST

Each of the 7 questions has a value of 14.3 points. The total possible score is 100 points. A passing score is 80 points or more.

1. (c)
2. Permanent
3. 1 or 2
4. Earth
5. A. Parallel runways
   B. Intersecting runways
   C. Direction markers
   F. Overrun area
   G. Center line
   H. Edge stripe
   I. Taxiways
   Q. Threshold
   R. Usable length of runway
6. L. Hangar apron
   M. Terminal parking
   N. Hangar
   U. POL storage tank
   T. Terminal building
7. (b) Terminal

☆ U.S. GOVERNMENT PRINTING OFFICE : 1986 O - 491-036 (45795)